CHARLESWATER

Technical Manual

CP925A

µMEG® POCKET MEGOHMMETER

Racal Mobilcal Ltd.
Test Equipment Maintenance Department
Location:=
D1
ID 1437

MP MASTER
MA23528

PURCHASE RECORD:

Fill in the following information about your new Charleswater Instrument. This information will be required for Warranty Servicing:

Serial Number _____

Installation Date _____

Purchased From: _____ Factory Customer Service Rep *or*

_____ Authorized Charleswater Distributor

Purchase Order Number: _____

TECHNICAL ASSISTANCE AVAILABLE
9:00AM - 5:00PM ET
(617) 964-8370

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μMEG® POCKET MEGOHMMETER
MODEL CP925A

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1. INTRODUCTION

This manual provides complete technical information for the μMeg® Pocket Megohmmeter Model CP925A. Please record the serial number of your unit in the space provided inside the front cover, and keep this manual for future reference. Warranty information is provided inside the back cover.

1.1 Product Description

The CP925A MicroMeg Pocket Megohmmeter is designed as a portable test instrument for measuring both surface and surface-to-ground resistance of static dissipative and conductive materials for use in static-safe work areas. This instrument is ideally suited for Quality Control and Field Service as well as for routine auditing of your ESD Program.

The MicroMeg features one-button, error-free operation by employing advanced silicon-gate ASIC electronics and exclusive bi-electrode sensors. Supplied with rechargeable batteries, this megohmmeter is designed for constant use and maximum portability. The high-impact plastic case ensures durability despite the meter's light weight: this state-of-the-art, auto-ranging instrument provides top performance, yet weighs only six ounces. Seven color-coded LEDs, read from right to left, easily identify static dissipative and conductive ranges.

1.2 Key Features

- Accurate and easy to operate with advanced silicon-gate ASIC electronics
- No power cables, wires or electrical hazards to assure safe operation
- Bi-electrode sensors test all types of materials without error
- Rechargeable batteries allow 1,000 tests per charge
- Supplied with cable for surface-to-ground measurements in addition to standard surface measurements
- LEDs are color coded to provided instant identification of surface classification: conductive (yellow) or static dissipative (green)
- Special red LEDs indicate battery power-on and potentially static-generating high surface resistances (greater than $10^{9.5}$)

2. SPECIFICATIONS

Static Control Characteristics

Sensitivity Range	
Surface Resistivity	Less than 10^5 to Greater than $10^{9.5}$ ohms/sq
Surface-to-ground	Less than 10^8 ohms
LED Key (from right to left)	
1. Red	On, and Battery OK
2. Red	$< 10^{9.5}$
3. Green	$< 10^9$ Static Dissipative
4. Green	$< 10^8$ Static Dissipative
5. Green	$< 10^7$ Static Dissipative
6. Yellow	$< 10^6$
7. Yellow	$< 10^5$ Conductive
Test Sample Size	3" x 1½" or larger

General Characteristics

Power Supply	Rechargeable, 10.8 volt battery (included)
Test Voltage	Nominal 10 volts
Electrodes	Gold-plated steel and conductive rubber
Temperature Range	
Operating	40°F to 120°F (10C to 40C)
Storage	(-15C to +60C)
Relative Humidity	0% to 90% (non-condensing)
Operation	Resistance bridge
Readout	Six LEDs
Resolution	One order of magnitude
Accuracy	±10%
Repeatability	±5%
Weight	6 ounces
Dimensions	3-3/8" x 2-1/2" x 1-1/4"

3. INSTALLATION

The CP925A μMeg® Pocket Megohmmeter has the added feature of surface-to-ground capability: the charging jack, located on the left side, also functions as a surface-to-ground measurement jack. The surface-to-ground cord should be plugged in *only* when the MicroMeg is being used for surface-to-ground measurements. The cord should be stored unplugged from the meter. A convenient vinyl carrying case is available from your Charleswater distributor for stowing the meter and its cord when not in use.

Always inspect your instrument's packing carton for signs of damage. If there are any signs of damage from shipping, you may want to contact the carrier to file a claim. Each carton should contain an undamaged MicroMeg (with a fully-charged battery installed), a Surface-to-Ground Cord, a 110 volt battery charger, and a technical manual. 220 volt battery rechargers, AC power supplies, and vinyl carrying cases are available separately.

4. OPERATION INSTRUCTIONS

The CP925A MicroMeg measures resistance by setting up a bridge between two precision 1% resistors of known value (R10 and R9 on Figure 1) and the surface tested, of unknown value. The two bottom electrodes on the outside of the meter are connected to this resistance bridge. The test voltage resulting from the bridge is compared to reference voltages established by six trimmers (R11 through R16 on Figure 1). Two integrated circuits (U1 and U2 on Figure 1) are configured as comparators to check the voltage from the bridge against the trimmers. Based on the setting of each trimmer, the appropriate LED is lit.

4.1 LED Key

Resistance readings are indicated by a series of LEDs on the face of the meter. The LEDs are read from right to left as follows:

1. RED -- Meter is on, and battery is functioning
2. RED -- Less than 5×10^9
3. GREEN -- Less than 1×10^9
4. GREEN -- Less than 1×10^8
5. GREEN -- Less than 1×10^7
6. YELLOW -- Less than 1×10^6
7. YELLOW -- Less than 1×10^5

Each LED indicates one order of magnitude of resistance. If the test surface is conductive to less than 10^5, *all* the LEDs will be lit. If it is neither conductive nor static dissipative, *only* the red "On" LED will be lit.

4.2 Surface Resistance Measurements

The CP925A meter makes surface resistance measurements using three electrodes. A test voltage of 10 vdc is applied to the meter's center electrode. The remaining two electrodes supply the resistance bridge.

To perform surface resistance tests, follow these simple instructions:

A. Check battery operation by depressing the white button on the center of the meter. (See Section 4.4 below.) The red "On" lamp at the far right should light to indicate proper battery functioning.
B. Place the meter on the surface being tested: all three electrodes should make contact with the surface.
C. Press the white button. The surface resistance will be indicated by the number of LEDs which light up: the more lights illuminated, the greater the conductivity of the surface.

4.3 Surface-to-Ground Measurements

The Surface-to-Ground feature is best used when expected results are less than 10^8 ohms, and when residual voltages can be removed from the test surface. Residual voltages may cause the two upper range LEDs to light, resulting in a false reading.

When the Surface-to-Ground cord is plugged in, the "live" center electrode on the bottom of the MicroMeg is disarmed, and the voltage is diverted to the test cord in order to measure resistance.

When making Surface-to-Ground tests, follow these procedures:

A. Check battery operation by depressing the white button (see Section 4.4). The "On" lamp will indicate proper functioning.
B. Plug the Surface-to-Ground cord into the left side of the meter.
C. Place the MicroMeg on the test surface.
D. Connect the test cord to the ground-point for the surface.
E. Press the white button. The LEDs will indicate the test results.
F. Unplug the cord when testing is finished.

4.4 Battery Operation

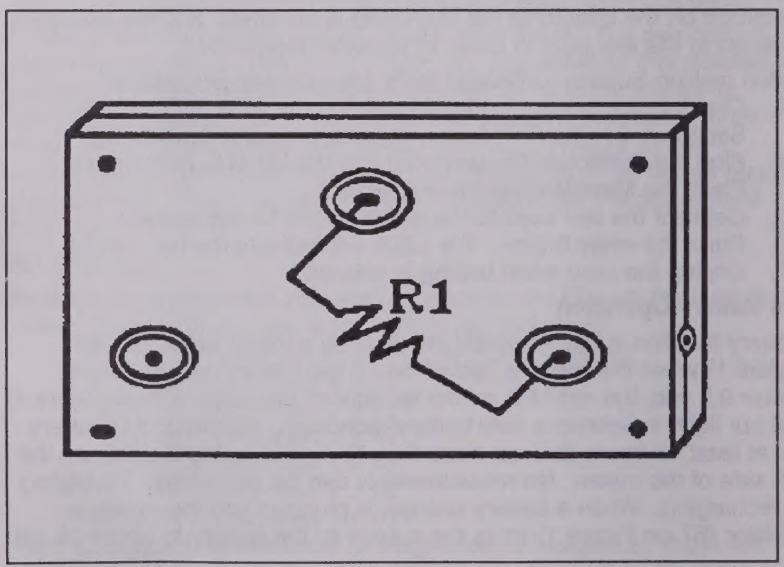
Battery function is automatically checked by a Zener diode (D8 on Figure 1) when the meter is turned on. If the battery voltage drops below 9.5 vdc, the red LED on the far right of the meter (D7 on Figure 1) will *not* light, indicating a "low battery" condition. Recharge the battery for at least *12 hours (but not more than 72 hours),* using the jack on the left side of the meter. No measurements can be taken while the battery is recharging. When a battery charger is plugged into the meter, a resistor (R7 on Figure 1) limits the current to the battery to below 10 ma.

4.5 Calibration Verification

The following test method describes the procedure for verifying the calibration of your CP925A MicroMeg. You will need 1% resistance standards (resistors) of the following values: 1×10^5 ohms; 1×10^6 ohms; 1×10^7 ohms; 1×10^8 ohms; 1×10^9 ohms and 5×10^9 ohms. These precision resistors will be placed across the two electrodes on the bottom of the meter (see figure below).

A. Place the MicroMeg on an insulator (e.g. Teflon or glass) and press the white test button. Only the first red LED on the right, marked "On", should be illuminated. If this LED fails to light, the MicroMeg should be recharged before proceeding.
B. Place the 5×10^9 resistor across the middle electrode and one of the side electrodes as illustrated below. Press the test button. The second LED should light.
C. Continue this process with each consecutive resistor, checking to make sure the appropriate LEDs are illuminated. If all resistors check properly, then the unit's calibration is verified.

NOTE: The model CP925 MicroMeg has only 6 LEDs. If you have this older model, begin this procedure with the 1×10^9 resistor.



5. MAINTENANCE

Your MicroMeg will require very little maintenance, and there are few user-serviceable parts. If your meter requires service beyond the simple procedures described below, refer to Section 6 for further information.

5.1 Suggested Schedule

The schedule below is suggested for routine care of your MicroMeg. A Maintenance Record page is provided in the Appendix of this manual (page 13) for your convenience.

CYCLE	*MAINTENANCE MEASURE*
3 months	Clean electrodes (Section 5.2)
6 months	Check Ground test cord (Section 5.4) Check calibration (Section 4.5)
12 months	Clean or replace electrodes (Section 5.2 or Section 5.3) Check calibration (Section 4.5) Check battery (Section 4.4)

5.2 Electrode Cleaning

To assure accurate measurements, the electrodes should be kept clean. Remove the electrodes from their snap-jacks using a screw driver to assist in un-snapping. Clean both the jacks and the electrodes with a cotton swab soaked in isopropyl alcohol. Check the rubber centers for wear: the rubber should form a convex spot on the bottom of the electrode. If the rubber is worn, order replacement electrodes (see Section 6.1), otherwise snap the clean electrodes back onto the meter.

5.3 Electrode Replacement

The CP924 replacement electrodes for the MicroMeg must be installed correctly to insure proper operation. Follow these instructions carefully:

A. Remove the old electrodes by placing a screwdriver under the lip of the gold cap and prying up to un-snap.
B. Remove the conductive rubber piece from inside the metal cap.
C. Clean the electrode cap and jack with alcohol.
D. Insert a new conductive rubber electrode into the cap with the widest end down. Be sure the rubber is pressed all the way in.
E. *Carefully* trim the rubber leaving 1/8" exposed above the socket.
F. Remove the rubber and insert it inverted (wide end up).
G. Place the new gold cap over the rubber and push into place.
H. The rubber should be protruding slightly through the hole in the cap. If not, give the cap a slight twist until the rubber is exposed.

Once you have replaced the electrodes, you may wish to make a quick calibration check (see Section 4.5) to assure that the electrodes are operative.

5.4 Checking the Surface-to-Ground Cord

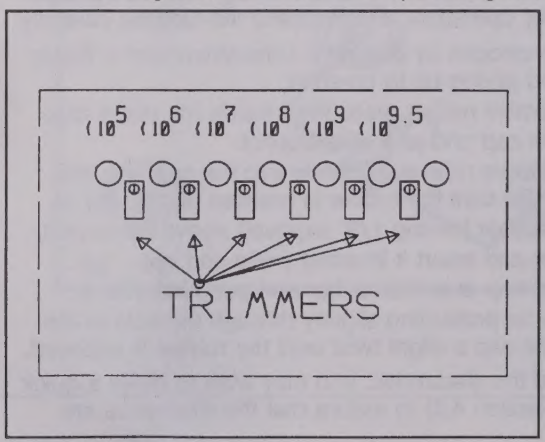
The Surface-to-Ground Cord should be checked occasionally to assure that it has not been damaged. Inspect the cord visually for signs of damage to the insulation and strain reliefs. There should be no bare wire exposed. Also check for bent or broken terminals, especially at the banana plug, where secure contact with the meter is required for accurate measurements. Finally, test the cord with a simple ohmmeter to make sure that the wire strands have not been severed inside the insulating jacket. You may test the cord with the MicroMeg when the cord is plugged in by touching the end to one of the lower electrodes: all LEDs should light. If this test fails, repeat with a different ohmmeter. Contact your Charleswater Distributor for a replacement cord.

5.5 Calibration Procedure

If you discover that your MicroMeg needs to be recalibrated, you will need precision resistors of the following values: 500K, 1%;5meg, 1%; 50meg, 1%; 500meg, 1%;5gig, 1%; and 10gig, 1%. To prevent personal charges from interfering with the calibration process, technicians should wear a static control wrist strap.

A. *Wearing a static control wrist strap,* open the meter case by removing the four screws on the underside of the unit. Lift off the cover, pushing the LEDs through their respective holes.

B. Following the procedure described in Section 4.5, or using a standard calibration block, begin calibration with the 10gig resistor: locate the 20-turn trimmer potentiometer, which is to the right of the "<9.5" LED (see diagram below).



Trimmer Diagram

C. Activate the meter by pushing the white test button.

D. Turn the trimmer *counter-clockwise* until the 9.5 LED lights up, then *clockwise* until the LED *just* goes out. Any sudden movement may make the LED flash momentarily. Do not turn the trimmer further than needed to turn the LED off.

E. Repeat with the remaining LEDs, using each successive precision resistor until all the trimmers have been adjusted.

G. Check the calibration (see Section 4.5).

H. Replace the cover, making sure that each LED is in the proper space and replacing the four screws.

Record each calibration on the record page provided (see page 13).

5.6 Troubleshooting

The following suggestions are intended to help you determine whether your MicroMeg requires servicing. If your meter needs repairs, consult the Warranty information provided inside the back cover of this manual. If you have any questions, please take advantage of our free technical assistance by calling (617)964-8370.

SYMPTOM	*CAUSE*	*CURE*
"On" LED not lit	Low battery	Recharge battery (Section 4.4)
	Failed LED	If battery has been recharged, yet the "On" LED will still not light, return the meter to the factory for servicing
"On" LED goes out during tests	Low battery	Recharge battery (Section 4.4)
Surface-to-Ground seems to give high results	Residual voltages on test surface	Use ionized air to remove residual charges and repeat the test
	Meter out of calibration	Recalibrate (Section 5.5)
Inconsistent or consistently high test results	Dirt on electrodes	Clean electrodes (Section 5.2)

6. PARTS & SERVICE

There are no user-serviceable parts in the μMeg®, with the exceptions of the battery and the snap-on outside electrodes. Servicing other than battery-charging and electrode replacement should be performed only at the factory.

6.1 Parts List

The following parts list is supplied to conform with certain industry standards. Most parts are available only to owners of MicroMeg units which are no longer under warranty. Charleswater Products makes no warranty, express or implied, nor accepts any obligation, liabilities or responsibilities in connection to repairs to MicroMegs, or replacement of MicroMeg parts, outside of Charleswater's factory.

In reading this list, refer to Figure 7.2 on page 11. Prices listed are subject to change without notice.

Stock No.	*Ref.*	*Description*	*Quantity*	*Price*
CZ-906-142	R1-R7	Resistor,820 ohm 1/4 W, 5%	6	$ 0.75
CZ-906-140	R8	Resistor,220 ohm 1/8 W, 5%	1	0.75
CZ-906-055	R9	Resistor,10 meg 50 ppm, 1%	1	4.00
CZ-906-049	R10	Resistor,51.1 meg 50 ppm,1%	1	5.50
CZ-906-060	R11-R16	Trimmer, 20K, 25 turn	6	5.00
CZ-906-070	C1	Capacitor, .0047, poly 1% 50V	1	0.75
CZ-906-085	D1,D2	LED, yellow, T-1 3/4	2	0.75
CZ-906-090	D3-D5	LED, green, T-1 3/4	3	0.75
CZ-906-080	D6,D7	LED, red, T-1 3/4	2	0.75
CZ-911-040	D8	Diode, Zener, 7.5 volt	1	$0.80
CZ-906-025	U1	IC, TLC272 Dual op-amp	1	2.50
CZ-906-030	U2	IC, TLC274 Quad op-amp	1	3.50
CZ-911-062	J1	Jack, 1/8 mini NC	1	1.50
CZ-906-120	S1	Switch, SPDT, MOM	1	6.00
CZ-906-115	*A2	Battery, 10.8 vdc rechargeable	1	16.00
CZ-906-100	A6	Male electrode holders	3	0.75
CP924	A7	Electrodes, gold-plated, 3/set	1	19.50
CZ-912-014	**	Rivets, 1/8 x 1/8	3	0.75
CZ-906-093	A8	Screws	4	0.75
CZ-906-010	*A3	PC board, main (empty)	1	125.00
CZ-906-012	*A4	PC board, sensor	1	9.00
CY-906-010	A1,A5	Case, top and bottom	1	18.00
CZ-900-S8'BLK	**	Surface-to-Ground Cord	1	5.95
CP925CARRY	**	Vinyl Carrying Case		8.00
CP954	**	220 volt battery charger		35.00
CY-925-010	***A3	Board, main, exc. battery	1	165.00
CY-925-020	***A4-A7	Base, complete, no electronics	1	35.00

** Refer to Figure 7.1 ** Not shown ***Combination Assembly*

All parts are warranted to be free from defect, but Charleswater accepts no responsibility or liability in connection with repairs to MicroMegs made outside of Charleswater's factory.

6.2 Service Information

Free technical assistance is available for any question involving the operation of our product: please call (617) 964-8370.

Service required as a result of misuse, abuse or negligence is not covered by our Warranty. Unauthorized modification of the unit will void all Warranties in their entirety. Our Warranty excludes reimbursement for inconvenience, installation, set-up time, loss of use, or unauthorized service. The Warranty covers only products made at the Charleswater factory, and is not extended to cover other equipment or parts that may be used with the unit. *Performance malfunctions involving the use of non-Charleswater equipment are the owner's responsibility.*

CALIBRATION

Any CP925A MicroMeg may be returned to the factory for calibration. There is a $29.00 flat fee for factory calibration: shipping costs are not included in this fee, and must be paid by the owner. Contact our Customer Service Department at (617)964-8370 for a Return Material Authorization. Written Purchase Orders are required for calibration services.

WARRANTY REPAIRS

Our Warranty begins on the date you purchase your MicroMeg. Damage incurred during shipment is the responsibility of the freight carrier. You must supply proof of purchase when requesting service or parts. See the instructions provided inside the back cover.

OUT-OF-WARRANTY REPAIRS

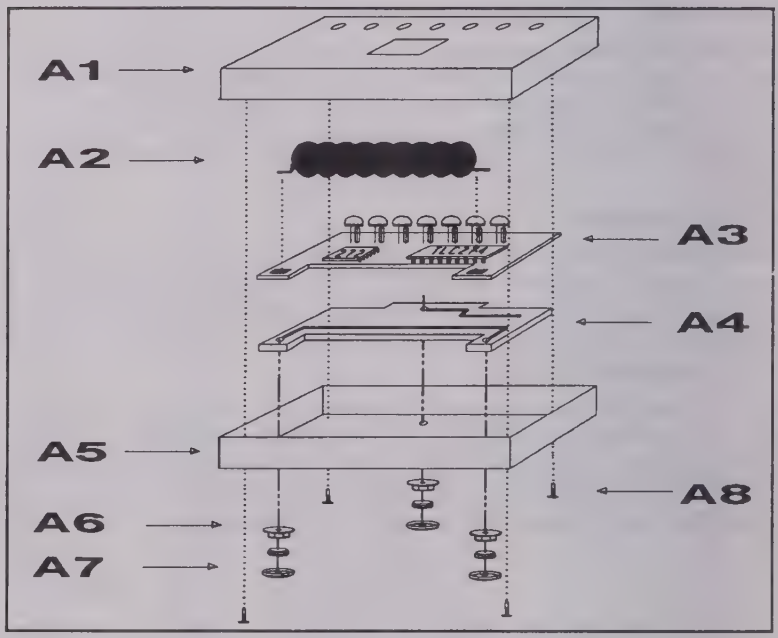
There is a $45.00 flat base rate for out-of-warranty repairs. Replacement parts will be charged at current prices. All factory repairs carry a limited 90-day guarantee. Owners are responsible for all shipping charges, and must obtain a Return Material Authorization (RMA) Number from Charleswater prior to sending any equipment for repair.

7. APPENDIX - Diagrams

The following diagrams contain proprietary information belonging to Charleswater Products, Inc., which is revealed for the limited purpose of allowing you to perform out-of-warranty service on your MicroMeg on the express condition that the information shall not be disclosed to others, and shall not be reproduced in whole or in part, or used as the basis for the manufacture or sale of any item.

7.1 Parts Explosion

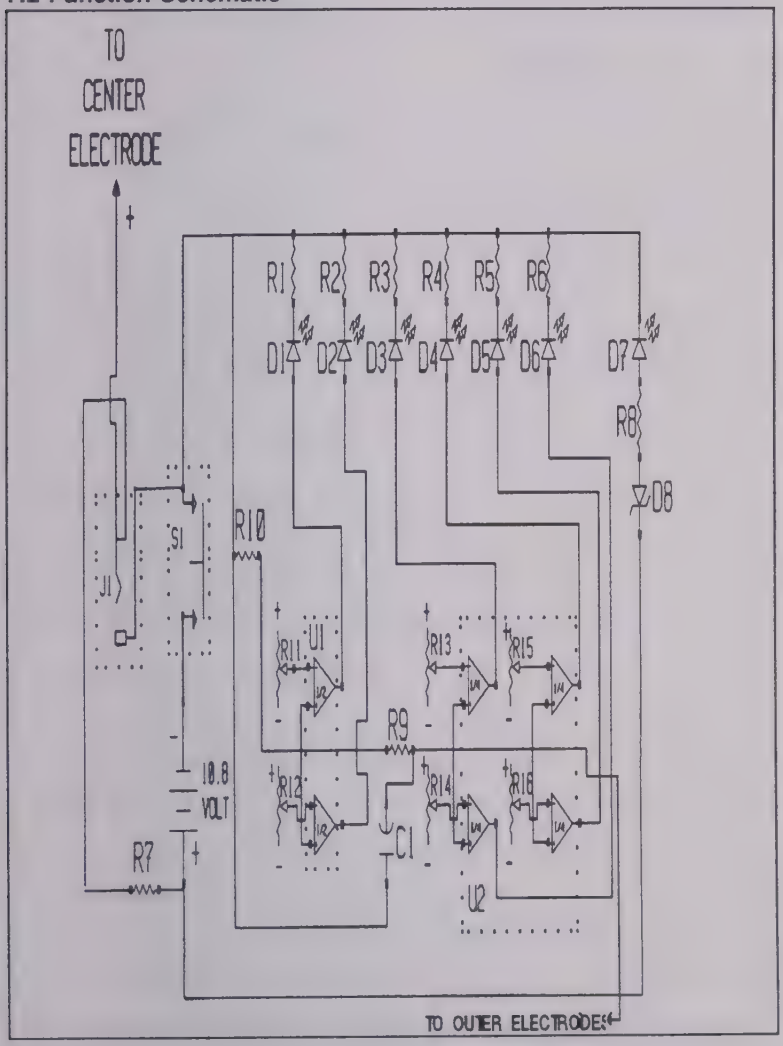
Stock numbers referenced below can be identified on the Parts List (Section 6.1)



A1 - Case, top	CY-906-010	A5 - Case, Base	CZ-906-010
A2 - Battery	CZ-906-115	A6 - Electrode jack	CZ-906-100
A3 - PC Board	CZ-906-010	A7 - Electrodes	CP945
A4 - Sensor	CZ-906-012	A8 - Screws	CZ-906-093

PROPRIETARY: DO NOT REPRODUCE

7.2 Function Schematic



PROPRIETARY: DO NOT REPRODUCE

7.3 Maintenance Record

Date *Description*

NOTES

WARRANTY

Charleswater Products, Inc. warrants this instrument to be free from defects in materials or workmanship upon leaving the factory until one year from the date of purchase.

Charleswater will, under this Warranty, repair or replace any unit which proves upon our examination to have become defective within the Warranty period. A one-year Warranty applies to this unit. The unit should be returned *by the purchaser* to Charleswater Products, Inc. at 93 Border Street, West Newton, MA 02165. Transportation must be prepaid, and the unit must be insured for its full purchase price. Prior to returning any goods for any reason, contact Customer Service at (617) 964-8370. If the unit was purchased direct from the factory, Customer Service will issue a Return Material Authorization (RMA) number. This number must accompany all returns. If the unit was purchased from one of Charleswater's Authorized Distributors, you must return the unit to that Distributor, who will process the unit for servicing. This Warranty does not apply when the instrument has been abused or damaged, misused, improperly installed, altered, connected to improper line voltage, or has been serviced by anyone other than an authorized factory representative.

Charleswater Products makes no Warranty, express or implied, nor accepts any obligation, liabilities or responsibility in connection with the use of this product other than the repair or replacement of parts as stated herein.

Charleswater Products, Inc.
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